6-5 The student will demonstrate an understanding of the law of conservation of energy and the properties of energy and work. (Physical Science)

Key Concepts
Sources and properties of types of energy: heat, solar, chemical, mechanical, electrical
Types of mechanical energy: potential and kinetic energy
Energy transformation: law of conservation of energy
Interrelationship of electricity and magnetism: electromagnets, generators, simple electric motors
Energy transformation in electric circuits: light, sound, heat, mechanical motion,
Heat energy transfer: convection, radiation, conduction
Energy = W**ork**= force exerted over distance
Simple machines: levers, pulleys, inclined planes; common tools, complex machines

Supporting Content Websites

American Association for the Advancement of Science
http://www.kineticcity.com/controlcar/activity.php?virus=enervia&act=4
Different kinds of energy have different advantages. Some are cheap, some are safer for the environment, and some are very efficient. Usually, though, you can't get all three. In this game, your job is to provide power for a gigantic city. But you need to do it without running out of money or ruining the environment. (6-5.1, 6-5.3, 6-5.4)

BBC
http://www.bbc.co.uk/schools/scienceclips/ages/10_11/forces_action.shtml
This website gives students the opportunity to experiment with forces. An online quiz assesses basic concepts about forces. (6-5.6)

California Energy Commission
http://www.energyquest.ca.gov/
This website provides numerous resources about types of energy and energy conservation. It includes teacher and parent resources, puzzles, games and energy stories. (6-5.1, 6-5.2, 6-5.3, 6-5.4)

http://www.edheads.org/activities/simple-machines/
This website contains a variety of interactive activities about Simple Machines. Explore a house and a tool shed to discover simple machines. (6-5.8)

http://volweb.utk.edu/Schools/sullivan/colonial/electricity.html
This webquest is designed to explore conductors and insulators, series and parallel circuits, electric charge, electrical current, electrical safety, electrical power and fossil fuels. (6-5.1, 6-5.2, 6-5.3, 6-5.4)

http://edtech.kennesaw.edu/web/electric.html
This site contains several links to a variety of websites about electricity. It also includes activities and lesson plans. (6-5.1, 6-5.2, 6-5.3, 6-5.4)

Intel
http://www97.intel.com/en/ProjectDesign/UnitPlanIndex/InventAMachine/
This an exemplary Intel Teach to the Future Unit in which students study the concepts of force, motion, and work as they analyze simple machines. They study the simple machines in complex machines, and track the transfer of force from input (effort) to output (work). In a design challenge, students become inventors and identify work they want to perform, and invent a labor-saving machine to do the job. The design steps of planning, drafting, construction, troubleshooting, and reliability testing are followed before students unveil their wonderful inventions to an awed crowd. (6-5.6, 6-5.7, 6-5.8)

National Energy Education Development Project
http://www.eia.doe.gov/kids/energyfacts/science/formsofenergy.html
This site contains information about forms of energy, conservation of energy, and energy efficiency.
(6-5.1, 6-5.2, 6-5.4)

Thinkquest
http://library.thinkquest.org/20331/
The website discusses different types of energy, potential and kinetic energy and conservation of energy. The energy crisis is described as well as alternative sources of energy. (6-5.1, 6-5.2, 6-5.4)

Suggested Literature

Bartholomew, A. (2002) *Electric Mischief: Battery-Powered Gadgets Kids Can Build.* Toronto, Canada. Kids Can Press.
ISBN 1550749234
Electric Al shows kids how to make their very own electric backscratcher, illuminated fork and more kooky creations using step-by-step instructions and easy-to-follow illustrations. The book features information on battery connections and switches as well as lots of ideas for building on the basics. (6-5.4, 6-5.2)

Bloomfield, L. (2005) *How Things Work: The Physics of Everyday Life*. Boston, MA. John Wiley and Sons.
ISBN: 047146886X
This book conveys an understanding and appreciation for physics by finding physics concepts and principles within the familiar objects of everyday experience. The book includes information on simple machines, force and energy. (6-5.6, 6-5.7, 6-5.8)

Farndon, John. (2002) *Energy*. Salt Lake, UT. Benchmark Books
ISBN: 07614-1469-X
Several classic science experiments are included in this book with clear explanations of the activities. (6-5.1)

Karpelenia, J. (2004) *Heat*. Logan, IA. Perfection Learning
ISBN: 0-7569-4449-X
Presents a study of heat energy and how it works and discusses the sources of heat, how heat changes things, temperature, radiation, convection and conduction, and body heat. (6-5.4, 6-5.5)

Oxlade,C. (2000) *Machines.* Baltimore, MD. Ottenheimer Publishers
ISBN: 1-84215-085-5
Explains how nineteen kinds of simple and complex machines work and presents step-by-step, photo-illustrated instructions for twenty-three related projects. (6-5.7, 6-5.8)

Parker, S. (2000) *Electricity and magnetism*. Orlando, FL. Raintree.
ISBN: 0-7398-1010-3
Information in the form of charts, diagrams, and photographs is presented here that clearly illustrates the concepts of electricity and magnetism. (6-5.3)

Richard, J. (2005) *Work and Simple Machines*. Mankato, MN. Stargazer Books
ISBN: 1-932799-64-8
Uses simple experiments to explore wheels, pulleys, levers, friction, and lift in terms of inventions and discoveries underlying the modern mechanical world. (6-5.5, 6-5.7)

Sanders, N. (2004) *Energy Transfers*. London: Orlando, FL. Raintree.
ISBN: 1-41090-494-6
An excellent explanation of energy transfers is provided in this book. Some of the forms of energy which are discussed include gravitational, chemical, electric, and nuclear energy. (6-5.2)

Thomas, K. (2004) *How Baseball Works*. New York, NY. Firefly Books
ISBN 1894379616
Using a great mix of illustrations and photographs, this seven-chapter book explains the physical science concepts embedded within the game of baseball.
(6-5.1, 6-5.6, 6-5.7)

Wells, R. (1996) *How do you lift a lion?* Morton Grove, IL. Albert Whitman & Co.
ISBN:0-8075-3419-6
650L
How would you lift a Lion? Pull a Panda? You could do it with three simple machines, levers, pulleys, and wheels. This book presents several physical science concepts about simple machines in an informative way. (6-5.7)

Suggested Streamline Video

Getting to Know Energy
ETV Streamline SC
Segment 4: Forms of Energy
Examples of different types of energy and examples and explanations of types of energy, including, heat, solar, chemical, electrical, and mechanical energy. (6-5.1, 6-5.4)
05.58 to 15.58
Segment 5: Potential and Kinetic Energy
Good examples of energy transformations and a through description of potential and kinetic energy. (6-5.2, 6-5.4)
15.09 to 19.25

Junior Electrician: Current Electricity
ETV Streamline SC
Segment 1: Introduction
This segment gives many examples of the ways in which electricity is used and how energy transformation powers every day objects. (6-5.3)
0:00 to 1:25
Segment 6: Electromagnets
Provides a demonstration of how an electromagnet is made. (6-5.3)
9:56 to 11:09

Getting to Know Electricity
ETV Streamline SC
Segment 8: Electromagnetism
This segment shows the relationship between electricity and magnetism to create electromagnets. (6-5.3)
8:30 to 10:45

Electricity and Magnetism: Magic of Magnets
ETV Streamline SC
Segment 3: Electromagnets
Describes the discovery of electromagnets and how electromagnets are made. The science behind electromagnets is also examined. (6-5.3)
7:39 to 10:11
Segment 4: Electricity from Magnetism
This segment provides a historical background of the discovery of electricity from magnets. The segment also shows how electricity can be created from magnetism and the applications of this process. (6-5.3)
10:12 to 11:56

Heat, Temperature, Energy
ETV Streamline SC
Segment 3: Heat: The flow of energy from one thing to another
Provides examples of a variety of examples of heat energy and describes of the ways in which heat energy may be converted to other types of energy and vice versa. (6-5.2)
2:25 to 5:34
Segment 8: Convection
Defines convection and provides examples of where convection may occur. (6-5.5)
13:27 to 14:57
Exploring Heat
ETV Streamline SC
Segments 11-14: The Movement of Heat, Conduction, Convection, Radiation
Provides definitions of each type of heat transfer and provides examples. (6-5.5)
13:49 to 19:14

Work, Energy and the Simple Machine: Work and Energy
ETV Streamline SC
Segment 1: Work Defined
Work is explained and defined with a variety of examples (6-5.6)
0:00 to 2:18
Segment 2: Energy Defined
Energy is explained and defined with a variety of examples (6-5.6)
2:19-6:09

Work, Energy, and the Simple Machine: Inclined Plane, Wedge, Screw
ETV Streamline SC
Students will see and learn how these three simple machines are closely related. Common everyday situations are used to illustrate and demonstrate the widespread use of these machines. (6-5.7)
0:00 to 15:00

Work, Energy, and the Simple Machine: Lever, Wheel and Axle, Pulley
ETV Streamline SC
These three simple machines, as different as they may appear, are actually closely related. The principles behind each of these simple machines are illustrated and demonstrated with common situations and tools. (6-5.7)
0:00 to 15:00

Work, Energy, and the Simple Machine: Compound Machines
ETV Streamline SC
This program shows how the six simple machines can be found in use in very complicated machines. The six simple machines are the basis for all other machines. Many examples of compound machines, machines that use two or more simple machines, are presented and analyzed. (6-5.8)
0:00 to 15:00

Career Connections

Electrical Engineer
An electrical engineer designs, develops, and tests the manufacturing and installation of electrical equipment, components, or systems. An electrical engineer may work in industry, the military or in scientific research. An electrical engineer plans and implements research methodology and procedures to apply principles of electrical theory to engineering projects.

Electrician
An electrician installs, maintains, and repairs electrical wiring, equipment, and fixtures. They use their knowledge of circuits to make sure that all the electric wiring in your house is safe and does not catch fire. They also will "string" wires from an electric generating plant to give electric power to houses, schools and businesses.

Heating Mechanic
Heating mechanics and installers—also called technicians—install, maintain, and repair heating and ventilation systems. Heating mechanics and installers are adept at using a variety of tools, including hammers, wrenches, metal snips, electric drills, pipe cutters and benders, measurement gauges, and acetylene torches, to work with air ducts. They use voltmeters, thermometers, pressure gauges, and other testing devices to check airflow, electrical circuits, burners, and other components.

Mechanical Engineer
Mechanical engineers research, develop, design, manufacture, and test tools, engines, machines, and other mechanical devices. They work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. Mechanical engineers also design tools that other engineers need for their work.

Physicist
Physicists explore and identify basic principles and laws governing motion and gravity, the generation and transfer between energy, and the interaction of matter and energy. Physicists design and perform experiments with lasers, telescopes, mass spectrometers, and other equipment. On the basis of their observations and analysis, they attempt to discover and explain laws describing the forces of nature, such as gravity, electromagnetism, and nuclear interactions. Physicists also find ways to apply physical laws and theories to problems in electronics, optics, communications, aerospace technology, and medical instrumentation.